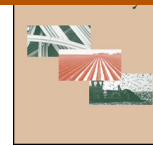




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## A tale of two villages: An investigation of conservation-driven land tenure reform in a Cambodian Protection Forest

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## ABSTRACT

In this paper, we present an analysis of the change in household land use following a conservation-driven process of indigenous land titling reform in a Cambodian protected area. In each of the two study villages, we investigated how household land use had changed and the extent of compliance with both legal boundaries of titled areas and community regulations created to govern land use within these areas. A comparison of current household land holdings in each village with those at the start of the tenure reform process indicated a significant increase in household land holdings. Changing land use practices were also revealed, as households shift away from traditional subsistence based land use towards more commercialised agriculture. Household compliance was observed to be strongly correlated with total land holdings and participation in the tenure reform process, with compliance levels significantly higher in the village that had experienced lower levels of external land grabbing and immigration. Similarly, understanding and perceptions of the tenure reform process was found to differ dramatically between the two study villages. The importance of supporting local resource management institutions created through tenure reform, particularly in the face of strong external drivers of change, and of engaging with immigrant households are highlighted as key to the continuing effectiveness of participatory land use planning approaches.

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## Introduction

Sparsely populated, resource rich forest habitats have frequently been subject to exclusionist policies by national governments, repeatedly failing to recognise the rights of the people living inside such areas (Colchester, 2004). Biodiversity conservation has a particularly chequered past in this regard, with the protectionist ‘fences and fines’ approach dominating conservation practice throughout much of its history (Adams, 2004). Given the high biodiversity value of many forest habitats and often weak political representation of forest peoples, it is no surprise that this approach has brought conservation practitioners and forest inhabitants into conflict (Brockington and Igoe, 2006). More recently, Government efforts to meet commitments made under the Convention of Biological Diversity (CBD) to set aside areas for the protection of

biodiversity have brought further accusations of ‘green grabbing’ (Fairhead et al., 2012).

From the 1980s onwards, however, there has been increased recognition of the customary rights of indigenous peoples, with both international resolutions and national legislation slowly moving to reflect this. This has been reflected within conservation, with article 8(j) of the CBD, decision 7.23 of the 2005 CBD Conference of the Parties and the CBD’s 2010 Aichi target 18 all requiring signatories to respect the rights and practices of indigenous and local communities. Beyond international agreements, there has been increasing acceptance within conservation organisations that the rights of local communities must be considered, which has resulted in a movement towards the principle of ‘doing no harm’ as a minimum requirement (Adams et al., 2004).

This change of approach is well reflected in the increasing trend towards the adoption and recognition of various forms of indigenous or community conserved areas (ICCAs). As of 2008, it was estimated that ICCAs encompassed over 400 million ha in 28 of the world’s 30 most forested states, a significant increase on similar calculations from 2002 (Sunderlin et al., 2008). This represents

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a significant step forward in the recognition of customary tenure rights, although rights-related issues are often not the primary impetus behind the adoption of ICCAs (Berkes, 2009). One argument in support of ICCAs lies in their perceived effectiveness in providing greater protection benefits in comparison with more traditional forms of conservation management. Whilst there is no guarantee that ICCAs result in positive biodiversity outcomes, there is some evidence that points in this direction (for a review see Shahabuddin and Rao, 2010). Furthermore, as payments for environmental services schemes become increasingly widespread, clarification of disputed or informal tenure arrangements becomes ever more necessary to ensure that payments are effective and customary rights holders do not lose out (Engel et al., 2008; Milne and Niesten, 2009; Larson, 2011).

In part, the success of rights-based approaches is dependent on the manner in which they are implemented. The rise of ICCAs was preceded by greater interest in participatory approaches to conservation (Agrawal and Gibson, 1999; Berkes, 2004) and in this regard participatory land use planning approaches have gained considerable support. Such approaches are thought to be an improvement on top-down land use planning methods, ensuring that the process is more inclusive, makes greater use of local knowledge, reduces the risk of future disputes and supports local level institutional development (McCall and Minang, 2005; Cronkleton et al., 2010). Concerns have been raised, however, regarding the effect of participatory land use planning approaches on local land use and the degree to which land access ultimately reflects power arrangements within a village. In an investigation of pilot participatory land use planning projects in Laos, Lestrelin et al. (2011) found evidence to suggest that, despite village participation, the process resulted in maintenance of the status quo, with the extent of individual households' access to land dependent on their power to negotiate with village elites. It should, however, be noted that the participatory planning process in upland Laos has been criticised for being a vehicle for the imposition of land stabilisation policies, which casts doubt on the ability of communities to have any meaningful input regarding planning outcomes (Ducourtieux et al., 2005; Lestrelin, 2010).

Despite participatory land use planning approaches being widely applied in multiple contexts and for different purposes, published case studies are rare and outcomes are often left unevaluated (Bourgoin, 2012). Where case studies have been published, there is a distinct lack of analyses looking at how different groups within villages have been affected by and comply with the institutional changes brought about by participatory tenure reform instruments. In this study, we seek to redress this gap. We evaluate the implementation of indigenous land titling, a product of a participatory land use planning process, in two villages in the Cambodian uplands, investigating at the household level how land use has evolved following the initiation of this process. We do this in the context of a dynamic but varying socio-economic landscape that is driving significant land use and demographic change. In this way, we are able to compare the performance of tenure reform in two villages that have been exposed to different levels of social and economic change.

We present an analysis of household land use change and compliance with both the legally binding zonation of community lands and community-agreed rules governing land use within community zones. The land holdings of individual households had been measured at the beginning of the process in each village. We re-measured these holdings for a sample of households in each village and compared the size, location and use of the holdings to that recorded as part of the process. We used these data to evaluate the extent to which the indigenous customary lands and the agreed conservation areas of the two communities have been successfully protected from land conversion from forest to agriculture. We

analyse how individual household land use has changed since the start of the land tenure reform process, in the context of rapidly changing social and economic circumstances (in particular, immigration of poor landless households). Within this analysis, we investigate the effects of different socio-economic characteristics thought to affect land use decision-making, including ethnicity, available household labour, livelihood options, wealth and residency, on the behavioural response of households to land tenure reform. We also examine understanding of the tenure reform process and perception of tenure security in each of the study villages. We believe that this provides a valuable case study from which to draw lessons, not only for the implementation of land tenure reform for Cambodia's minority indigenous peoples, but for participatory approaches to land use planning more widely.

### Indigenous land tenure reform in Cambodia

Cambodia is home to several minority indigenous peoples (believed to make up between 1% and 1.4% of Cambodia's total population; National Institute of Statistics, 2008; Anderson, 2011), the majority of whom live in remote forested upland areas, often in and around gazetted protected areas (PAs). Although customs and practices vary between groups, Cambodia's minority indigenous peoples have typically operated under a traditional system of collective customary land tenure with a strong spiritual connection to the surrounding landscape, particularly forests (ADB, 2002; Baird and Dearden, 2003; Fox et al., 2008; Simbolon, 2009; Baird, 2013a). Traditional livelihood systems relied heavily on small-scale swidden agriculture, in which only a modest proportion of communal lands were cultivated at any one time. While swidden land use has often been considered to have a negative impact on forest ecosystems and subjected to efforts to 'stabilise' agricultural production (e.g. Lao land reforms; Ducourtieux et al., 2005; Lestrelin, 2010), there is evidence to suggest that such systems can be sustainable (Fox et al., 2000). In recent years, however, there has been a shift in many communities away from traditional agricultural practices, with increasing reliance on the production of commercial and tree crops (Fox et al., 2008).

Largely unaffected by the private property regime of French colonial rule, Cambodia's minority indigenous peoples came under increasing pressure to integrate into Khmer society after independence, culminating in forced integration and mass resettlements during the Khmer Rouge period (1975–1979). Following Vietnamese invasion in 1979, Cambodia's minority indigenous peoples were allowed to return to their ancestral lands (except in areas still occupied by Khmer Rouge forces), although many did not return until the 1990s. After the 1991 peace accord, a series of laws aimed at reforming land ownership was enacted, most notably the 2001 Land Law. From the perspective of indigenous communities, the 2001 Land law is particularly important, as it was the first piece of legislation to legally recognise the existence of Cambodia's minority indigenous peoples (Baird, 2013b). It also provides the legal basis to secure customary land rights and safeguards those rights until such a time as legal title is granted. Once title is granted, these lands are classified as state private lands, meaning that they remain the property of the state but have no public interest (Oberndorf, 2005). As such, communities do not hold the right to dispose of their land. In order to apply for indigenous communal tenure (ICT), a community must first register as an indigenous community (IC) and be recognised as such by the Ministry of the Interior.

Whilst the 2001 Land Law provided the basis for ICT, there was a long delay until the government passed the 2009 sub-decree on the procedures for registration of the customary land of indigenous communities. For much of this time, it was unclear what legislation would follow, though it was widely believed that the government would support a participatory approach to land use planning.

Such an approach had first been applied in Cambodia in Ratanakiri Province in the 1990s and the government had subsequently shown an interest in extending its use. In 2001, an implementation manual for government staff and development workers was published (Rock, 2001). As such, it was felt by many that implementing participatory land use planning would be a first step towards securing land tenure for communities and for defining the boundaries of customary use within protected areas. Eventually, it became clear that this approach would not make its way into Cambodian legislation and, at that point, efforts switched mainly to working within the ICT framework. Partly as a consequence of this, progress towards ICT has been slow, with only seven villages having received title at the time of writing (a further 160 are planned; Milne, 2013).

The stipulation under the 2001 Land Law to grant communal land rights to Cambodia's minority indigenous peoples was been criticised for only granting such rights to a small minority of Cambodia's population and for limiting those rights to agricultural land, rather than extending them to forests (Baird, 2013b; Milne, 2013). There is also some concern that, with respect to the recognition of a community as 'indigenous', the law has adopted a static view of what it means to be indigenous by linking this to a community's adherence to traditional agricultural and cultural practices (Baird, 2013b). This has added to issues regarding how individuals choose to identify themselves and how they are identified by Cambodian authorities (Swift, 2013).

Despite legal reform recognising the rights of Cambodia's minority indigenous peoples and rural smallholder farmers, land disputes, alienation and large-scale land grabbing are frequent and widespread. While large-scale land acquisitions are by no means a recent phenomenon in Cambodia, the situation has been greatly exacerbated in recent years. The human rights NGO ADHOC reports that 2,657,470 ha (approximately 17% of the total land area of the country) had been granted as economic land concessions (ELCs; areas of up to 10,000 ha granted to industrial companies for intensive agriculture), as of December 2012 (ADHOC, 2013). Not only has this had extreme implications for Cambodian smallholder farmers but also for conservation. In 2012 alone, ELCs covering 381,121 ha were granted, of which over 70% are within existing protected areas. Given the high degree of overlap between Cambodia's minority indigenous peoples and the country's protected area network, efforts to secure minority customary rights may also serve as added protection from ELCs for protected areas.

### Land tenure reform in the two study villages

The study was undertaken in two villages in Monduliri Province, northeastern Cambodia: Andong Kraloeng in O Reang District and O Rona in Keo Seima District (Fig. 1). Both villages are located within Seima Protection Forest (SPF), a former logging concession that covers a total area of 2926 km<sup>2</sup> and is now managed by the Forestry Administration (FA) with technical and financial support from the Wildlife Conservation Society (WCS; Evans et al., 2012). The predominant minority indigenous group in the area are the Bunong, who belong to the Mon-Khmer language family (Bourdier, 2009). During the Khmer Rouge period, the area was almost totally abandoned, as households living there were forcibly resettled in the lowland north of Monduliri, with the majority of families returning in the 1990s and early 2000s (Evans et al., 2012). This resulted in the partial loss of knowledge regarding the boundaries of customary land (P. Phaktra, pers. comm.). In 2003, PA authorities took the strategic decision to initiate a programme of participatory land use planning with local villages in order to protect the customary rights of indigenous communities within the PA and to counter two of the main drivers of deforestation at that time (agricultural expansion by local villagers and forest clearing

**Table 1**

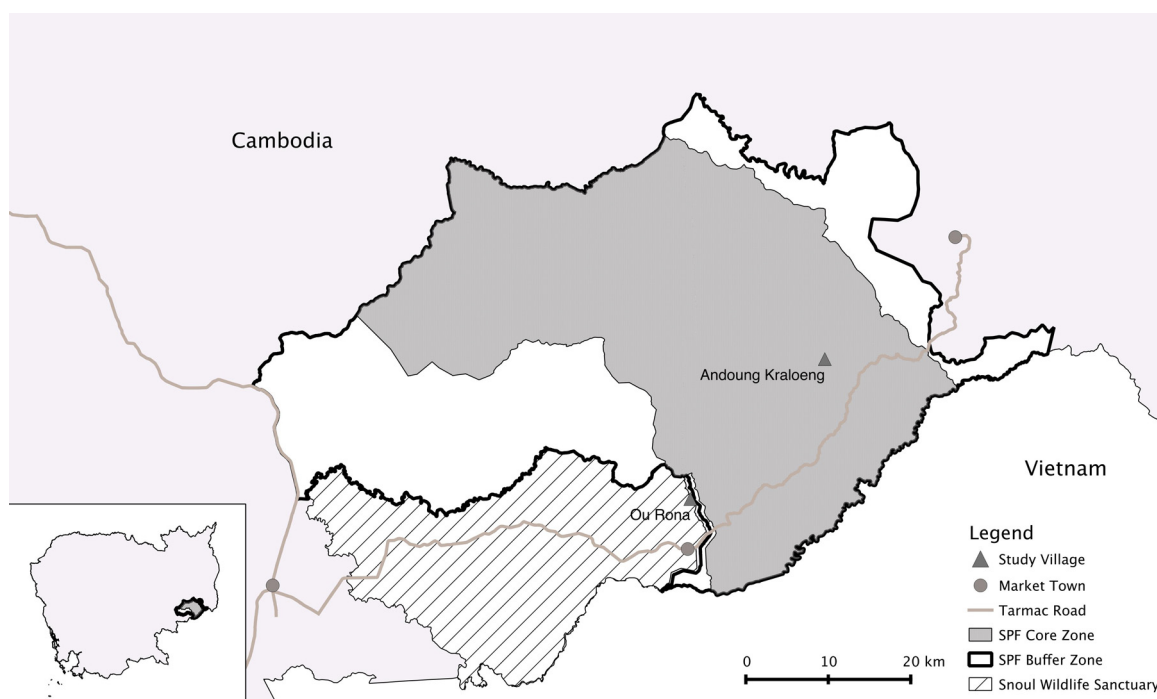
Details of the participatory land use planning process in the two study villages. Land inside zones designated for agriculture is a mix of cultivated land and forest that, as yet, has not been cleared.

	Andong Kraloeng	O Rona
<i>Zone areas</i>		
Residential/agriculture	1323 ha	1477 ha
NTPF forest	23,584 ha	2274 ha
Spirit forest	43 ha	44 ha
Burial forest	27 ha	–
Total village area	25,003 ha	3795 ha
<i>IC formed/land mapped</i>		
IC application	2003	2005
ICT application	2008	2009
ICT zones redrawn	2010	Dec 2012
ICT granted	2011	2013
<i>Population (heads)</i>		
Start of PLUP process	390 (2004)	573 (2006)
June/July 2012	563	1041
<i>Number of households</i>		
Start of PLUP process	93 (2004)	121 (2006)
June/July 2012	124	229

by migrant households; Evans et al., 2012). This programme, which was initially piloted in Andong Kraloeng and later expanded to include other villages (Evans et al., 2012), involved a series of consultations with local communities, following procedures based on the government's manual for participatory land use planning.

Andong Kraloeng is a Bunong village, consisting of six smaller sub-village settlements, located within the densely forested core zone of SPF on the main road between Phnom Penh and the provincial capital, Sen Monorom. Despite being situated along the main road, it has been little affected by immigration from other provinces. In 2011, a sub-decree was passed recognising the rights of the Andong Kraloeng IC, making them the third IC nationally to be granted rights over their customary land (UNOHCHR, 2011). The second study village, O Rona, is located at the edge of SPF and the adjacent Snoul Wildlife Sanctuary (SWS), managed by the Ministry of Environment (MoE), and consists of five smaller sub-village settlements. Historically, the village was an indigenous Bunong community but in recent years it has been heavily affected by an influx of immigrant Khmer families seeking land. As the village is situated close to both the district capital and the border with Vietnam, it is considerably more integrated into the market economy than Andong Kraloeng. This has affected traditional livelihoods, with a greater reliance on commercial agriculture readily apparent amongst Bunong households. It also presents a greater threat to community lands from speculators and immigrants; at the time that the land tenure reform process was initiated in 2005, there were 35 claims to land inside the traditional village boundary from households living in other villages.

At the start of the ICT process in both villages, a provisional Indigenous Community was set up. Under Cambodian law, formal recognition by the Ministry of the Interior of a community's status as an indigenous community is a legal pre-requisite for applications for ICT. For each IC, PA authorities facilitated the local people to select a committee, with committee members drawn mainly from traditional village elders. Every indigenous household living in the village at that time elected to join. Following this, the former extent of customary use was investigated using a variety of sources (including historical topographical maps, aerial surveys, forest inventories and local knowledge) and all land holdings within the provisional village area were mapped by PA authorities. On completion, a series of zones was created delineating areas of different land use (Table 1). These included zones designated for current and future agriculture, as well as community forest in which the only form of resource use permitted is the collection of non-timber



**Fig. 1.** Map of Seima Protection Forest (2926 km<sup>2</sup>), showing the location of the two study villages.

forest products (NTFPs). These zones are managed by the IC committee.

In addition to the creation of the different land use zones, the ICT process supported the agreement of a series of rules governing household land use, made enforceable by traditional village sanctions, to assist in the management of village land. These regulations, which were largely drawn up from informal traditional practices, were designed to allow the IC to plan for future growth but also to protect traditional livelihoods. As such, limits were put on the area of paddy land and tree crops allowed for each household. A village constitution, which details the formal composition of the committee, the goals of the IC and criteria for IC membership, was also drawn up.

The main difference between the procedure followed in O Rona and that of Andong Kraloeng was the number of Khmer migrant families living in the village at the time of the ICT process. Under the 2001 Land Law, households are entitled to claim ownership of occupied land provided their claim had been uncontested for at least five years prior to the promulgation of the law. Land claimed after 2001 is not eligible for private ownership and under law remains state property. Although the ICT process in O Rona included every household living in the village, households belonging to the majority Khmer ethnic group were only permitted to retain the land they already occupied as they are excluded from the communal title granted to the IC. Any expansion of their land within those areas identified for future agricultural use would be illegal under the 2001 Land Law. This created a two-tiered system within the village, with Khmer immigrant households granted fewer rights than their returnee Bunong neighbours. This was not an issue in Andong Kraloeng as there were no Khmer households in the village at the time of the ICT process. In both villages, the rules governing land use within the village area apply only to Bunong households and to the Khmer households present during the ICT process, as recent settlers are not permitted to claim any land within community zones. Newly formed households of married children of IC members automatically become members of the IC, with the accompanying land use rights and responsibility to abide by community rules.

## Methods

Fieldwork for the study was carried out in both villages between May and July 2012, and consisted of a series of focus group discussions, household structured interviews and land use mapping.

### *Focus group discussions*

The aim of the focus group discussions was to gain a better understanding of land use practices and to investigate local perceptions regarding land issues. Each focus group consisted of 8–15 participants and lasted approximately two hours. In each village, one focus group was held with members of the IC committee responsible for the management of community zones. In O Rona, three additional focus group discussions were held, which separated participants who had been present at the time of the initial planning exercise and those who had not, as there is a strong distinction in rights between newly arrived and resident households. In Andong Kraloeng, immigration rates are low and the population relatively homogeneous, so this was not deemed necessary.

### *Household interviews and land use mapping*

Structured household interviews and land use mapping were conducted for 114 households, with 44 sampled in Andong Kraloeng and 70 in O Rona (approximately one third of the households in each of the study villages), stratifying proportionally by sub-village settlement and randomly sampling within each stratum. No households living outside either of the villages were sampled. This approach provided a cross-sectional sample and was selected to ensure that both newly arrived immigrants and newly formed households (e.g. through marriage) were included in the study. As the original land use mapping process included every plot of land within each community zone, a cross-sectional survey design provided sufficient matches between the two time periods to allow for simple panel analyses.

The purpose of the structured interviews was to collect socio-economic and land use data for each household, as well as gathering information on perceptions of land issues and knowledge of the ICT process (see Supplementary Materials for questionnaire used). Where possible, all interviews were conducted with the head of each household and lasted for approximately 45 min. Following the completion of each interview, all land parcels held by the respondent household were measured by walking the parcel edge and recording the path taken on GPS. Observations were made regarding the crops grown, the likely age of those crops and adjoining land uses and owners to triangulate information given during interviews.

#### *Land use mapping check*

A set of 100 random points was sampled across each village area, and the owner of the land at each point identified, in order to check whether information about sensitive plots was being withheld during the interviews. Given that a significant proportion of households hold land illegally, it was considered likely that participants might opt to withhold sensitive plots. As sampling within each village was incomplete and did not cover land claimed by outside interests, uncertainties existed regarding whether the team had been shown all plots used by the households sampled. Recent land cover analysis (WCS, unpublished) and satellite imagery were used to identify areas under cultivation. Random points were generated within un-visited areas of cultivated land for each settlement using ArcMap version 10.0. Local guides or members of the village ICT committees assisted in identifying the landowner at each point. The names collated were then cross-checked against the list of households already interviewed to ascertain whether any plots had been withheld. This provided a measure of the number of withheld plots for each village. In cases where plots had been withheld, the household head was re-interviewed and the plot mapped. Interviewers were careful at this stage to stress that they were clarifying the details given during the original interview and to avoid any accusation that the respondent had deliberately misled the research team.

#### *Spatial compliance analysis*

Land use compliance was measured against two sets of criteria: with the law and with IC regulations governing land use within community boundaries. Plots measured in 2012 as part of this study were compared with those of each household as measured during the previous ICT process and with the various boundaries created through the ICT process. In certain cases, records were incomplete, which had the effect of reducing the overall sample size for the compliance analyses to 105 households. These spatial comparisons were carried out using Quantum GIS version 1.8.0. A margin of error of 0.05 ha or 5%, depending on which was greater, was used to allow for differences in digital and physical boundaries.

For Andong Kraloeng, these analyses were made more complicated as zone boundaries were changed in 2010. This created a situation where plots that had previously been compliant were made non-compliant and vice versa. In the former case, plots were considered to be compliant for the purposes of this analysis, despite the boundary changes. In the latter case, plots were considered non-compliant if they were outside community agricultural zones when initially cleared, but compliant if they were within community agricultural zones when cleared. For both cases, it was necessary to use reported plot age, triangulated against observations made during plot measurement, to check whether the plot had been cleared at the time the boundaries were changed. For O Rona, the boundaries had not been changed at the time of the survey so this was not an issue. In both villages, however, it was necessary to correct for whether or not each household was a member of the IC. In Andong

Kraloeng, all non-members of the IC were excluded from holding land within the community zone, but at the beginning of the ICT process all households were members of the IC. In O Rona, non-IC households that were present in the village at the beginning of the ICT process were allowed to keep the land they owned at that time but any further expansion was prohibited, while households that had moved to the village afterwards were excluded from claiming land.

In addition to analysing land use compliance with the law, we also checked for compliance with five regulations governing land use within IC managed zones. These were regulations banning: (1) buying, selling or renting land, (2) clearance of spirit or burial forest, (3) exceeding 2 ha of land for tree crops (such as cashew or rubber) per household, (4) exceeding 1 ha of land for cultivation of paddy rice per household and (5) exceeding 5 ha of land under any form of cultivation per household. In each case, if these regulations had been broken prior to the rules being drawn up, then the household was considered compliant provided that there were no new infractions. For example, if a household cultivated 7 ha of land prior to the start of the ICT process, they were allowed to keep all 7 ha. If, however, they subsequently cleared more land within the community zone, they were judged to be non-compliant with the 5 ha area limit. For the purposes of this analysis, only land within the community zones was considered, as the IC regulations only govern land use within these zones.

#### *Statistical modelling*

Linear and generalised linear mixed models (LMMs; GLMMs) were selected using backwards step-wise selection methods based on the small sample size corrected Akaike Information Criterion (AICc; Akaike, 1974; Burnham and Anderson, 2002).<sup>1</sup> Models with the lowest AICc were selected except in cases where a more parsimonious model was found with a  $\Delta$ AICc value of less than two. The variable settlement, which referred to each sub-village settlement surveyed, was included as the only random effect in all models (see Supplementary Materials for a list of the explanatory variables considered for each model).

In order to model the area of household land claimed illegally, we used a hurdle modelling approach to account for the high number of zero values (Mullahy, 1986). Compliance with the 2001 Land Law was modelled first using a simple binary variable. Subsequent modelling of correlates of illegal land area claimed was carried out only for those households with some illegal land. All area variables were transformed using natural logarithms. In cases where area variables contained zero values, a constant equal to half the lowest non-zero value was first added to all data points. The exception to this was for the model of total area held per household. For this model, three zero value data points were removed and the sensitivity of the coefficients tested. Removing these data points did not have a significant effect on the model estimates and greatly aided interpretation of the results.

In each case, once the final model had been selected, visual validation was conducted to check for residual normality, heteroskedasticity and possible correlations between fixed effects and the residuals. Over-dispersion in binomial logistic regression models was checked by comparing the sum of squared Pearson residuals with the approximate residual degrees of freedom. No issues were found in any checks.

<sup>1</sup> All statistical analysis was carried out using R version 2.15.1, on RStudio version 0.97.314. Within R, the lme4 package version 0.999375-36 was used to analyse all models.

**Table 2**

Mean area (ha) given to different land uses per household for the two villages at the time fields were mapped by PA authorities as part of the ICT process and in 2012. The percentage of average household area given to each land use is shown in parentheses. As intercropping is common practice, percentages do not sum to 100.

Land use	Andong Kraloeng		O Rona	
	2004	2012	2006	2012
All cultivation	1.0	2.7	3.1	4.8
Cash crop (cassava, cashew and rubber)	0.6 (62)	2.5 (93)	2.9 (94)	4.2 (88)
Tree crop	0.7 (68)	1.4 (50)	2.8 (90)	1.9 (40)
Rice	0.9 (85)	0.2 (7)	0.8 (26)	0.6 (13)
Cassava	0.0 (0)	1.8 (67)	0.1 (3)	3.0 (63)

## Results

### Land use change in the two villages

#### Andong Kraloeng

In Andong Kraloeng, 44 households were interviewed, of which 43 currently hold land (see Fig. A.1 in Supplementary Materials for plan of mapped fields). Overall, the area held by each household increased significantly between 2004 and 2012 (Table 2). A shift away from traditional indigenous land use systems was also observed. Such systems tend to be highly diverse, with many different crops commonly grown in small amounts around the edge of the same parcel of land (Baird and Dearden, 2003), so we limit ourselves here to discussing changes to the dominant crop in each field. The most dramatic change observed is the transition to commercial agriculture and a simultaneous decrease in the area of rice cultivation. The increase in the total area on which cash crops (cashew, cassava and rubber) are grown was greater than the increase in land held per household (Table 2). There was also a significant increase in the area under tree crop cultivation, which points to an erosion of traditional rotational farming practices.

The area held by sampled households totalled 133 ha, with 119 ha in cultivation. This represents a significant expansion in the average area of land under cultivation per household, from 1.0 ha in 2004 to 2.7 ha in 2012 (Table 2). Extrapolating this land use for the entire village population gives a total area under cultivation of 334 ha, which remains a small fraction of the 1398 ha granted to the IC for agricultural and residential purposes, and shows that there remains considerable scope for agricultural expansion.

In 2004, the average area under some form of cash crop cultivation (principally cashew) was 0.6 ha per household, or 62% of the land under cultivation. Much of this land, however, was also used to grow non-cash crop upland rice intercropped with the main cash crop. For instance, 0.5 ha per household, equivalent to half of all land use within the village, was used for cashew plantations with rice grown underneath or between young trees. By 2012, the average area of cash crops had risen to 2.5 ha per household, or 93% of the area cultivated. The majority of this increase is accounted for by the emergence of cassava, a crop that was unrecorded in 2004. In 2012, the average cultivated area of cassava was 1.8 ha per household (67% of the cultivated area), with 1.4 ha per household intercropped with cashew. In contrast, the importance of rice (the main subsistence crop grown) had dropped, with only 0.2 ha (7% of the cultivated area) per household cultivated with rice as the dominant or intercropped crop. Whereas, in 2004, 85% of cultivated land (0.9 ha) had rice as the dominant or intercropped crop.

Not only does this show an increasing reliance on producing cash crops but it also shows a breakdown of traditional rotational farming. As of 2012, cashew, a tree crop, was present in approximately 1.4 ha of land per household (up from 0.6 in 2004), much of which was formerly used for growing rice (Table 2). As cashew is considered to have a 20 year productive life span, land that would

**Table 3**

Parameter estimates for the household land holdings LMM, with  $\ln(\text{area})$  as the response variable. One random effect was included in the model: settlement (std. dev. = 0.191). The full list of variables modelled, plus their explanations, are given in Supplementary Materials.

Variable	Estimate	SE	t value
Intercept	-2.565	0.503	-5.095
Age	0.015	0.006	2.526
Poverty score	0.338	0.049	6.828
Immigrant	-0.622	0.199	-3.132

formerly be returned to fallow, and therefore collective ownership, is now being retained as individually held land (albeit within communal title) through the planting of cashew.

#### O Rona

In O Rona, the average land holdings per household were found to be significantly higher than for Andoung Kraloeng and also demonstrated a rapid expansion in the land being cultivated since the beginning of the ICT process (Table 2; see Fig. A.2 in Supplementary Materials for plan of mapped fields). However, changes in land use practices were not as striking as in Andoung Kraloeng. Here, commercial agriculture was already widely practiced in 2006, and the proportion of household land holdings on which cassava, cashew and rubber were grown was essentially unchanged between surveys, although the absolute area was much increased (Table 2).

The main observed difference between the two time periods was the change in intercropping practices between commercial and subsistence crops. A significant drop was observed in the area of land on which rice, a subsistence crop, was intercropped with one of the main cash crops. This was matched by an increase in the area of land given solely to rice cultivation (largely through new areas suitable for paddy farming being cleared), such that the total area of land under rice cultivation did not change significantly (Table 2). This suggests an increasing delineation between areas assigned to growing cash crops and to subsistence rice cultivation.

As with Andong Kraloeng, the most dramatic shift in O Rona was the uptake of cassava, which was first introduced in 2005. Less than 0.1 ha per household was being grown in 2006 but this had increased to over 3 ha per household by 2012. This, in part, is driving the changes observed in rice growing practices, as cassava is often sold to traders by the field. Households, often those short of labour, agree a sale price set by the area of their field and quality of the cassava, as opposed to harvesting and processing the cassava themselves. Consequently, it makes sense for households to have separate plots for different crops, even within the same field.

The emergence of cassava has also changed the area given to tree crops. In 2006, the average household had 2.8 ha of tree crops, largely intercropped with rice, but by 2012 this had dropped to 1.9 ha and was intercropped with cassava instead. This demonstrates a trend reported during household interviews that some farmers have chosen to replace areas previously planted with tree crops with cassava. Overall, however, the reduction in area planted with tree crops does not indicate a return to traditional rotational cultivation as cassava is being grown year after year, despite fears of declining yields.

#### Household land holdings

The selected model for the total log transformed area of land held by each household in 2012 included three significant explanatory variables (Table 3): the age of the head of the household, whether or not they had arrived after the ICT process was initiated and an adjusted poverty score based on the basic necessity survey methodology (Davies, 1997; see Supplementary Materials for an

explanation of how this score was calculated). This meant that neither the household's livelihood options nor available labour had a significant effect on land holdings.

There was a positive effect of age on household land holdings, predicting an increase of 1.5% in the area held for every year increase in the age of the household head. A much stronger correlation was found for the adjusted poverty score. In this case, a unit increase in adjusted poverty score (indicating that a household is becoming better off) was found to be associated with an increase of 34% in the total area held. This results in a predicted 232% difference in the total area of land held between the best off and poorest families. Immigrant households, however, were found to have smaller land holdings, with the model estimates predicting that households that arrived after the ICT process had started had 62% less land on average.

#### Household compliance

##### Compliance with the 2001 Land Law

Overall, there were high levels of non-compliance in both study villages, although distinct differences in behaviour between the two were observed. In Andong Kraloeng, 26% of cultivated land had been cleared outside agreed boundaries, whereas the figure for O Rona was 47%. Similarly, while 52% of sampled households in Andong Kraloeng were found to have some illegal land, this figure was 79% in O Rona. Comparing the performance of the indigenous communities within each village reduces this difference slightly, with 49% of IC member households non-compliant in Andong Kraloeng and 67% in O Rona.

In order to investigate compliance, we first looked at whether or not a household held any illegal land, constructing a GLMM with a binary household compliance variable as the response (see Supplementary Materials for model summary table). Only two explanatory variables considered for selection were included in the final model; whether the household was part of the village IC and the natural log transformed area held by each household. The difference in compliance between the two villages was accounted for by the inclusion of the settlement lived in by each household as a random effect in this model.

As the interpretation of logistic regression coefficients is not intuitive for log transformed variables with constants added to account for zero values, we plot the effect of the area held by each household on the probability of compliance with the 2001 Land Law for both IC and non-IC member households (Fig. 2). Among non-IC member households, only those with very little land are likely to comply with the law. This result is, perhaps, unsurprising, as non-IC members have little right to land within either village. As the majority of sampled non-IC member households live in O Rona, this result strongly reflects the two-tiered system that was created there. In fact, the three non-member households that have not claimed land illegally hold no land at all and provide labour for other households. None of the 20 sampled non-IC member households that were present in the village in 2006 was found to be compliant with the law in 2012.

Comparing the curves for IC and non-IC households reveals a strong positive effect of being an IC member on compliance. This effect diminishes rapidly, however, as the area of household land holdings increases. The predicted probability of being compliant with the law for an IC member holding the average area of land is just over 0.2, illustrating the very low levels of compliance for families with average or greater land holdings (Fig. 2).

The second part of the compliance hurdle analysis comprised a linear model with the log-transformed area of illegal land held by non-compliant households as the response. Three fixed effects were included in the final model (Table 4): the total land holdings of each household, whether households were members of the IC and

**Table 4**

Parameter estimates for the illegal household land holdings model, with  $\ln(\text{illegal area})$  as the response variable. *P* values significant at the 95% confidence level are shown in bold. The full list of variables modelled, plus their explanations, are given in Supplementary Materials.

Variable	Estimate	SE	<i>P</i> value
Intercept	-0.359	0.156	<b>0.025</b>
$\ln(\text{area})$	1.084	0.107	<b>&lt;&lt;0.000</b>
IC member	-0.500	0.246	<b>0.046</b>
Indigenous	-0.521	0.245	<b>0.037</b>

whether the household head was Bunong. This final variable was possible because several Khmer men had married Bunong women and moved into their wives' home villages. Under the rules drawn up by each IC, these households automatically became IC members even though the head of the household was Khmer. The results of this model again show a strong correlation between compliance and the total area of land held by each household. In this case, an increase in the total area of 1% resulted in a 1.1% increase in the area of illegal land held per household, suggesting that households hold legal and illegal land in roughly equal proportions.

More informative, from the perspective of evaluating the outcomes of the ICT process, are the effect estimates for being an IC member at the time the ICT process was initiated and for the household head identifying themselves as indigenous. The effects of these two variables are comparable, with an approximate 50% reduction in the predicted area of illegal land held in both cases. This suggests that, even among those households that had held land illegally, there is a positive effect on compliance from being a member of an IC. The second of these two results suggests that, holding the effect of being an IC member constant, households with indigenous heads hold less illegal land than those with heads from non-indigenous backgrounds.

##### Compliance with community regulations

The second aspect of household compliance considered was whether households complied with the set of five regulations that were drawn up as part of the original agreements in each village and which govern land use within community zones. Overall, IC regulations experienced a higher rate of compliance than observed for the 2001 Land Law. In Andong Kraloeng, 77% of households were found to be compliant with all five IC regulations considered. In O Rona, the figure was lower, with 52% of households compliant.

In Andong Kraloeng, three of the rules were obeyed by every household sampled: those prohibiting the buying and selling of land, clearing land in spirit and burial forest and exceeding 1 ha of paddy land (Table 5). The regulation with the lowest level of compliance was the limit on tree crop area, with all households who were not totally compliant breaking this rule. This reflects the changes in the traditional rotational cultivation system observed earlier. In O Rona, only the ban on clearance of burial or spirit forest was completely observed (Table 5). In contrast to Andong Kraloeng, nearly 50% of households were found to be breaking total area restrictions within the community zones. In part, this was due to non-IC

**Table 5**

Percentage of respondent households that were found to have complied with the five community land use regulations. Only land inside the community agricultural zones was considered.

Regulation	Andong Kraloeng	O Rona
Max 5 ha total area	92	56
Max 1 ha paddy land	100	94
Max 2 ha tree crop cultivation	77	81
Spirit/burial forest	100	100
No buying/selling land	100	92
All regulations	77	52

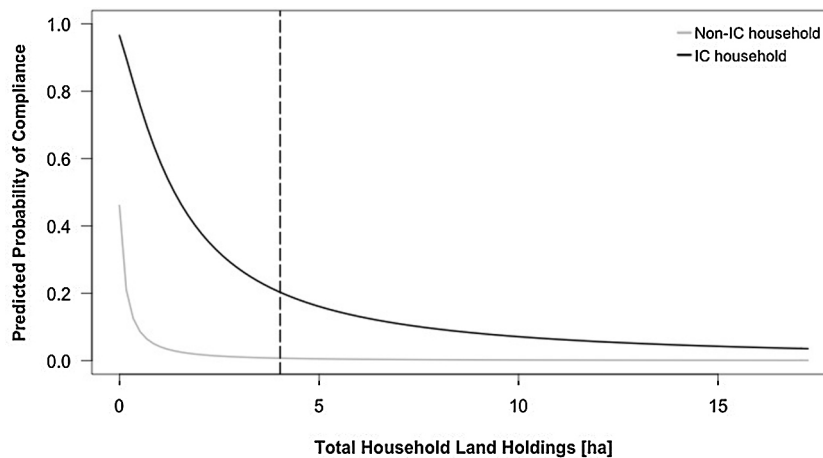


Fig. 2. Predicted probabilities of compliance with the 2001 Land Law for non-IC and IC households. The vertical dashed line shows the average area claimed per household for the whole sample.

member households claiming land that they had not possessed in 2006. At 68%, the compliance rate for IC members was still lower than in Andong Kraloeng, but higher than for the village overall.

A mixed model approach to analysing IC regulation compliance was deemed unnecessary in this case, as no difference in compliance was attributed to different settlements. Instead, a generalised linear model (GLM) was produced, with three explanatory variables included in the final selected model: the log-transformed total household land holdings, whether the household was an IC member and whether the household held some illegal land. The effect of the area held by each household on the probability of compliance with IC regulations is plotted for both IC and non-IC member households (Fig. 3; see Supplementary Materials for coefficient estimates).

Increased household land holdings are associated with a significant reduction in the probability of compliance with the set of five IC regulations. This effect is most striking for non-IC members (Fig. 3). It is also clear from comparing the curves for non-IC and IC member households that once again there is a strong positive effect on compliance associated with a household belonging to the village IC. Again, this is expected given the two-tier system in place in O Rona, in which non-IC members were afforded little right to land. Crucially, non-member households are not represented on the committee that manages community land. It is unsurprising, therefore, that households do not comply with regulations on which they have no say. Interestingly, the correlation between compliance with IC rules and compliance with the 2001 Land Law was negative. Comparing the curves in Fig. 3 for households with and without illegal land for both IC members and non-IC members separately, it is evident that households with illegal land have a greater probability of being compliant with the regulations governing land use in community zones over the full range of total land holdings. This implies that households may seek to circumvent IC regulations by clearing land outside of community zones, rather than breaking the regulations within the zones.

#### Perceptions of ICT

In addition to differences in land use, understanding and perceptions of the ICT process differed significantly between the two villages. In Andong Kraloeng, 90% of IC respondents displayed some understanding of the land use plan (this figure was only 46% of IC respondents in O Rona). There was also a much greater level of understanding in Andong Kraloeng that the responsibility for monitoring and sanctioning households who were non-compliant with the land use plans was split between the committee and the

protected area authorities. Whilst 44% of IC respondents in Andong Kraloeng mentioned the committee when asked who enforced the land use plans, the figure in O Rona was only 17%.

With respect to how the land use plans were perceived, community members in Andong Kraloeng were more likely to view the land use plans positively and to feel secure about their land tenure. In O Rona, IC members frequently queried the validity of IC regulations and restrictions on area, citing the failure of committee members (i.e. those charged with managing community resources) and other community leaders to observe them. The average land holdings for such leaders in O Rona were 8.6 ha, well above the limit of 5 ha set down in IC rules. Conversely, community leaders in Andong Kraloeng held an average of just 2.9 ha, which is below the village average. IC members in O Rona also felt less secure regarding their land tenure. Only 6% of respondent reported that they felt secure in their tenure, with most respondents worried about economic land concessions or powerful immigrants taking their land (in comparison 72% of IC respondents in Andong Kraloeng felt secure).

#### Discussion

This study reveals households in two villages responding to land tenure reform and drivers of land use change in different ways. In Andong Kraloeng, compliance with both the legal land use plans that were created as part of the tenure reform process and the community regulations that govern land use in community zones was relatively high. In O Rona, a village that has been strongly exposed to market forces and immigration, compliance rates were much lower, with extensive illegal land clearance within conservation areas and illegal settlement of Khmer migrants observed. The reasons behind these differences are complex and multi-faceted, yet they provide valuable lessons for further implementation of ICT in Cambodia, and participatory land use planning approaches more widely.

The most significant difference between the two villages is the degree to which they have been exposed to outside interests. Milne (2013) reports that over 500 'outsiders', ranging from smallholder farmers to influential politicians, claim land inside the provisional community zone in O Rona. This is in addition to the families that have moved into the village unopposed. As a direct result of losing land to these outside interests, the boundaries of the O Rona ICT have been substantially redrawn from those that were included in the original ICT application. That application contained plans for 1477 ha to be granted for communal agriculture and residential use, while only 648 ha has been included within the



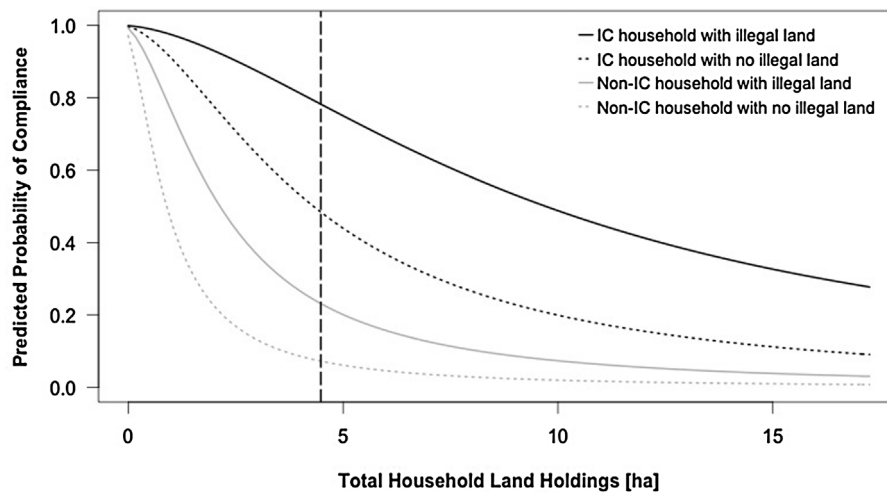


Fig. 3. Predicted probabilities of compliance with IC regulations. The vertical dashed line shows the average area claimed per household for the whole sample.

redrawn boundaries. The remaining 829 ha has been lost to outside interests or non-IC households in the period between the original application and receipt of ICT. Furthermore, the entire proposed western NTFP forest zone, which initially covered an area of 446 ha, has either already been deforested or has been included as part of the 648 ha designated for community agricultural use to compensate for the losses in this zone.

It is debatable how much individual households have been involved in the sale of community land to outsiders. Private access to land designated for indigenous community title claims is often achieved through the use of intimidation, misinformation and stealth (Fox et al., 2008; Milne, 2013). Under the 2001 Land Law, communities are not granted disposal rights, which makes it illegal to sell land within ICTs, but this has not stopped sales. Although we found little evidence of direct sales of land parcels, a recent study of tenure policy changes introduced to O Rona after the study was completed reports frequent selling of plots by Bunong to migrant Khmer families or outside land speculators (Milne, 2013). Such sales are considered shameful and, hence, frequently carried out in private (Fox et al., 2008). As such, reported compliance with the ban on buying and selling land in O Rona may under-estimate actual sales. However, a comparison of land mapped for IC households matched between the two time periods (and for whom the head of the household has remained the same) shows that 74% of the land mapped in 2006 has been retained. Given that households are expected to have given some of this land as wedding gifts when their children married, it is possible that the selling of land that is in use by IC households has been overstated (although this does not preclude the selling of previously unclaimed community land).

Whilst the extent to which IC households have been involved in the sale of land to outside interests is unclear, it is evident that the influx of external claims on community land has had a negative impact on IC households. In interviews, IC members frequently expressed frustration at their inability to exclude outsiders and the loss of community land. For example, one woman told us that “before people used to try to stop the immigrants, but now we fear outsiders because they are rich and powerful.” It is clear to them that their claim on the land, although recognised under law, is insecure, thereby eroding one of the main benefits of the provision of tenure. This in turn was used as a justification for clearing outside of designated community zones. As one man put it, “we have to clear outside the community boundaries because there is no more land available”. Despite these pressures, however, the ICT process appears to have been partially successful in conservation terms, as

IC members were less likely to claim illegal land and when they did claim illegal land, they claimed 50% less land than non-IC members.

In Andong Kraloeng, the IC has made a concerted effort to prevent large scale migration into the village, making access to land for outside interests significantly more difficult (albeit the village is under less pressure than O Rona). In part, this can be attributed to the village situation at the time land use planning was initiated. Unlike in O Rona, where the two-tier system was necessitated in response to already high levels of in-migration from non-indigenous households, Andong Kraloeng had very few migrant households settle in the village prior to ICT. Of the 44 households sampled in this study, only five were non-IC households. This has contributed to a stronger sense of community identity and ownership of customary lands, as well as greater belief in their right to exclude outside interests from their land. Consequently, villagers report having turned away numerous migrant households since receiving ICT. As such, those conditions most commonly associated with positive outcomes for tenure reform have been achieved and compliance (particularly in regard to IC rules) has benefited (Ostrom, 1990).

Despite the generally positive situation for Andong Kraloeng, there appears to have been a breakdown of the traditional rotational cultivation system in response to the emergence of cash crops over the past decade. This does not necessarily represent a failing of the ICT process as no system can be expected to remain static over time, particularly in the face of rapidly changing socio-economic conditions. It does, however, underscore the importance of allowing for possible changes as part of the planning process and of ensuring that the institutions that are created to manage community zones have the capacity to be able to respond to those changes. As agriculture becomes more commercialised in Andong Kraloeng, it remains to be seen whether social institutions within the village can adapt, particularly if it brings influential households into conflict with IC regulations. The results of the household analyses support this, with those households with greater land holdings (i.e. older, more affluent and more established households) more likely to be non-compliant with community boundaries and regulations and also found to hold more illegal land if non-compliant.

The results regarding the perceptions of IC members of the IC committees in each village suggest that the social processes and institutions that support the management of community land may play an important role in maintaining compliance with the defined community boundaries and regulations. In Andong Kraloeng, committee leadership is strong, with committee members seen to

be compliant with community regulations and legal boundaries, and ordinary community members display a greater awareness of the committee's role in managing community land. In O Rona, where the overall perception the IC committee is poor, the ICT process is largely considered to be an externally imposed intervention, and not supported.

This has important implications for how ICT and participatory land use planning approaches are implemented elsewhere. In other villages in SPF, for example, improved road access to more remote villages, and the increasing threat of land alienation caused by economic land concessions, has led to the acceleration of the ICT process. Whilst this has been forced by the changing conditions to which these villages are exposed, the FA and WCS must be careful to ensure that the necessary support is given to local social institutions, which are critical to the successful implementation and sustainability of IC managed lands. With its origins in the recognised need to support and empower local voices, this lesson is also particularly relevant to the implementation of participatory land use planning approaches more broadly.

Similarly important is the need to ensure on-going compliance monitoring, both within the community zones and the protected area, and to provide external support for this where required. The considerable loss of community lands in O Rona, and the perceived inability of IC members to prevent it, demonstrates that simply supporting a community through the legal processes required to apply for tenure is not sufficient. External political support may be necessary to assist communities in excluding outside interests from illegal land grabs. Without this, the security that the establishment of tenure should introduce may not materialise, leading to some of the issues observed in O Rona.

It may also be necessary to provide stronger enforcement of community boundaries. Unenforced boundaries will fail to induce sufficient incentive for local institutional development and effective management of community resources. In Andong Kraloeng, where the threat of external land grabbing is low and available land is far from scarce, 26% of land has still been cleared illegally. While it is possible that this is due to a lack of understanding of the rules that govern land use or of where the boundaries of each zone lie, it is more likely that these areas have been cleared despite an understanding that to do so would be illegal. Effective policing of such infractions is likely to increase the incentive for committees to manage land use within community zones more effectively. This is supported by the result of the community regulation compliance model, which suggested that households may offset their non-compliance with community rules (to which they may feel more social pressure to conform) through land use outside of community boundaries. As such, protected area authorities should support community monitoring and exclusion of outside interests within community boundaries, whilst ensuring adequate enforcement of community expansion beyond those boundaries.

## Conclusion

Through this study, we have seen how two contrasting villages have coped with implementing tenure reform. In one village, the evidence presented provides support for the proposition that tenure reform in protected areas conducted with the participation of minority indigenous communities can be consistent with positive outcomes for biodiversity conservation (in this case, retention of protected forest cover), whilst providing communities with the rights to customary lands. In the other village, these positive effects have been largely negated by severe disruption from outside interests, powerful market forces and a failure in leadership on the part of those local institutions created to manage communal lands. In such cases, it is in the interests of both communities and those seeking to further conservation for local people to be provided with

the institutional support necessary to protect and manage their resources effectively.

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## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.landusepol.2014.11.007>.

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